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## TWO SUGGESTIONS CONCERNING HEALTHY BUILDINGS.

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THE first suggestion is to build houses upon arches, particularly in cities situated in low flat grounds upon navigable waters, and also in the country where the soil is alluvial.

The second suggestion is to build a certain class of houses in our cities with flat roofs, with or without a clear story beneath them, and that some of these roofs be improved as gardens. The houses particularly designated in this certain class are back buildings, low warehouses, small manufactories, stables, etc. What I shall say concerning these suggestions will have reference both to public health and individual comfort.

Man has at least the department of building under his own control. He must take the earth as he finds it; but one style of building may be more healthy, useful, or convenient in one situation than another.

In the beginning of this paper, what I will request of you is, to divest your minds, as far as you can, of any bias in favor of the present, or the old-fashioned, modes of building houses in cities, or even in the country. You all know the effect of early prejudices, the tyranny of fashion, and the difficulty of introducing any reform. The suggestions I have made are radical changes from the present style of building; and in order to judge of the merits of these proposed alterations, will require from you entire freedom from prejudice. A brief description of the kind of buildings which are proposed will first be given, in order to show the principles involved, and afterwards a few of the advantages expected to be derived from this mode of construction.

In the city in which I live, there is a building, which was erected fifteen years ago, and as it is, in part, an illustration of the suggestions which have been made, a short description of it may serve the purpose of a more extended explanation. The building is twenty-five feet front by forty in depth, and is erected on a lot 140 feet deep, in the rear of a dwelling. The first thirteen feet of its height, which may represent the suggested arch, is used, for the convenience of its owner, as a stable; and above this stable, the next twelve feet in height, is a clear story used as a gymnasium; and these two stories are surmounted by a large basin also twenty-five by forty feet, and which is three feet and a half in depth. This basin, being water-tight, and properly filled with earth, is used as a garden or common sitting or pleasure place for the family in good weather, having grass, plants, and flowers growing upon it. This garden communicates with the second floor of the dwelling

proper, and is twenty-eight feet above the pavement. The manner of constructing this building was simple. It is built for the most part with large timbers, framed in no uncommon way; but the garden is supported by large beams and truss-beams, in order to sustain the heavy weight of earth. The floor and sides of the basin were made of inch and a half flooring boards, the sides having a flare of a few inches. The sides and floor were then covered with the "tar-roofing," and upon this, also both sides and floor, asphalt roofing blocks made for the purpose and cemented together with the usual hot cement, were laid. A layer of clay, six inches thick, was put upon these asphalt blocks. Three inches of the clay, being tempered, was rolled into flat cakes, and the other three inches was well puddled clay and laid on with shovels. When the clay was dry and the cracks secured, water was let into the basin to test the water-tightness of its construction. When this was found perfect, six inches of gravel was thrown into the bottom of the basin. Upon this, earth of a good quality was thrown, leaving a rim of about three inches at the top of the basin. The gravel gives a system of underground drainage, through two outlets near one end of the garden, towards which there is a fall of a few inches. This is a drainage similar to that of a "blind-ditch" in a meadow. The surface drainage is secured by the rim, which prevents overflow, and two down-spouts, towards which upon the sward there is also a fall of a few inches. The temperature of the air on the top of this garden is from two to five degrees lower, in hot weather, than that about three feet from the pavement. The air is fresher as well as cooler, and more invigorating than that nearer the pavement, which is heated by radiation from the bricks, and would be tainted in many situations by emanations from the streets and gutters.

In all compactly built towns, but particularly in our larger western and southern cities, the air on the plane of the second or third stories of ordinary dwellings is more agreeable and healthy than that in the basement or ground floors. Where yellow fever prevails it is recommended by physicians to sleep and live, as much as possible, in elevated apartments. The air held within an area of crowded buildings being obstructed as to its natural average motion by walls and fences, is prevented from a free ventilation, and is stagnated in streets, alleys, yards, and courts, to every degree of closeness. There is no chance for a free surface ventilation, and during close weather, in such situations, for many days at a time, the air which is retained is but little changed.

It is to be regretted that our knowledge concerning the emanations of gases, and air, from the crust of the earth is not more certain. That the earth does perform a function somewhat analogous to human respiration, is most probable; that is, the air penetrates the soil and water to a certain depth, is there changed, as in the animal lungs, and is again exhaled or expired through the pores of the earth or water. How much the expired air is changed in different situations, is always a subject for scientific inquiry. It is reasonable to suppose, that such atmospheric changes may be excited into action by laws similar to those which govern the motions of the air at different temperatures. Whatever may be the causes which originate, or the



laws which govern, terrene emanations, their existence cannot be questioned. In alluvial soils cellars are damper and more unpleasant than in primal formations, and obtain, and retain, an air which gives life to moulds and various air-plants.

Now, instead of springing the houses out of the ground in such situations by digging cellars, and continuing the communications with the houses above by solid walls, it is suggested to build arches as the foundations for the houses, so that a stratum of air may be interposed between the interior of the dwellings and the earth.

What advantages may be expected by such a change from the present style of building? As already said, surface ventilation of the air would be one prominent advantage. Cleanliness, surface drainage, convenience in city life, an abatement of certain nuisances, and consequent increased healthfulness, would be other advantages. It is not necessary to enumerate before this convention all the machinery which can now be so easily procured for carrying out the details of this desirable object. It is well known that such appliances are now at hand. Substitutes for cellars are being invented and put on the market; manufactories for asphalts and artificial stone are being established; convenient receptacles for holding the refuse and effete matters of a family are already made, so that such refuse can be readily transported to a distance without odor. Indeed, every detail for carrying out the conveniences for this principle of arch-building, can now be obtained at moderate expense, for even the largest cities.

The many kinds of elevators or lifts now in use, gives the idea a feasibility at present, which it did not have a few years ago. The hand, the steam, the hydraulic, and the gas motor elevators, are now commonly used. Arch-building, as well as the flat-roofs, are particularly adapted to southern cities, which are now rapidly advancing in importance, and where, in the near future, large amounts of capital will be invested. The ordinary perplexities and sufferings of mankind in general would be much relieved by this kind of building. As a negative good it would prevent the ground from being penetrated by sewers and pipes, or studded by pestiferous sinks of different kinds. Arch-building would solve the question of drainage in those cities built upon navigable water, where the land is low and flat and but little elevated above the tide, or the banks of the rivers at high-water, as in New Orleans. It might solve the question of drainage in this city. It is by water that foul places are washed and cleansed, and what chance is there to do this, in a large way, when there is no fall or flow for the water? What is called drainage, in cities thus situated, only results in hiding and accumulating excrements and refuse matters for future bad effects. As an illustration, examine the city of Savannah, where we are now. The water in the river is but a few inches lower than the highest hill in the city. In some other cities, as in New Orleans, the land is even lower than the water. It would probably cost less to raise the houses in that city upon arches, pave the earth with artificial stone at a small grade, and organize an efficient plan for the removal of nuisances, than any system of drainage that has yet been proposed. The great essayist of a former age has said, "I would have every

one write what he knows, and as much as he knows of it, not only on this, but on every other subject." The difficulties of the drainage question are universally known, where there is no fall for water. Carrying away the offals, and keeping a city clean by means of arch-building, is entirely another thing. If any of you should think, at first, that these ideas are impracticable, reflect upon them, for they will bear comparison with the old style of building. They are given here with a view to elicit comment and excite study.

As it regards the flat-roofs, with or without gardens upon them, they are beginning to be spoken of already in some of the cities of this country. Their attractions and usefulness must be admitted. It is one of the objects of this paper to multiply their friends and show their practicability. It is not proposed, as yet, to suggest them for the main structures of private dwellings. But for the "certain class" of houses mentioned the steep tin, tar, slate, or shingle roofs answer only the one single purpose of protection. The garden-roofs will protect as well as they, and besides this, they are beautiful, healthful, and hence trebly useful, although, in money, they need not cost three times as much. Some histories record that Queen Semiramis used lead in the construction of the celebrated hanging gardens of Babylon, but none was used in the garden already mentioned, which is more than twenty times less than the supposed dimensions of her's, and has not leaked in fifteen years, but seems to be equally sound as to its earth and timbers as when new. It was a boast of the renowned architect of St. Peter's in Rome that he would swing the Pantheon in the air. Imagine cities like Savannah, where we are now, or New Orleans, or Washington, swung in the air with their gardens thirty feet from the earth.

There is scarcely a limit to the many uses, to which such flat-roofs may be turned. In cities where cisterns are necessary they may be made into filters. This subject might be carried to greater length, but there are members of this convention, and others throughout the country, who can do this hereafter, in a more fitting time and place, with greater detail.

Permit me to say, in conclusion, that the two cities in this country, which should be most likely to give positive results from such suggestions, are New Orleans and Washington city. It is more to the interest of their inhabitants to try practical conclusions with such a style of architecture. New Orleans, on account of the immediate benefits to the health and comfort of its people; and Washington, because it is the capital of the nation, and should give example of progress. Again, imagine this national city with many garden-roofs tastefully ornamented. Will not the glare from the back buildings with the tin roofs, induce some one, wearing golden spectacles, to try the experiment? Those immense sewers under the ground in Washington, with the history of the National Hotel disease already written, and the ague in the White House, are they nothing? or, are they to be remedied? It would be a worthy monument for any man, if the arch of triumph, in this case, could be made the building arch.